Serial Quantitative Chest CT Assessment of COVID-19: A Deep Learning Approach

Abstract

Purpose To quantitatively evaluate lung burden changes in patients with coronavirus disease 2019 (COVID-19) by using serial CT scan by an automated deep learning method. Materials and Methods Patients with COVID-19, who underwent chest CT between January 1 and February 3, 2020, were retrospectively evaluated. The patients were divided into mild, moderate, severe, and critical types, according to their baseline clinical, laboratory, and CT findings. CT lung opacification percentages of the whole lung and five lobes were automatically quantified by a commercial deep learning software and compared with those at follow-up CT scans. Longitudinal changes of the CT quantitative parameter were also compared among the four clinical types. Results A total of 126 patients with COVID-19 (mean age, 52 years ± 15 [standard deviation]; 53.2% males) were evaluated, including six mild, 94 moderate, 20 severe, and six critical cases. CT-derived opacification percentage was significantly different among clinical groups at baseline, gradually progressing from mild to critical type (all $P < .01$). Overall, the whole-lung opacification percentage significantly increased from baseline CT to first follow-up CT (median [interquartile range]: 3.6% [0.5%, 12.1%] vs 8.7% [2.7%, 21.2%]; $P < .01$). No significant progression of the opacification percentages was noted from the first follow-up to second follow-up CT (8.7% [2.7%, 21.2%] vs 6.0% [1.9%, 24.3%]; $P = .655$). Conclusion The quantification of lung opacification in COVID-19 measured at chest CT by using a commercially available deep learning–based tool was significantly different among groups with different clinical severity. This approach could potentially eliminate the subjectivity in the initial assessment and follow-up of pulmonary findings in COVID-19. Supplemental material is available for this article. © RSNA, 2020